SPEAKING RATES OF TURKISH PRELINGUALLY HEARING-IMPAIRED CHILDREN

M. Cem Girgin
Anadolu University, Eskisehir, TURKEY
cgirgin@anadolu.edu.tr, mcgirgin@gmail.com

ABSTRACT

The aim of training for the hearing impaired children in auditory oral approach is to develop good speaking abilities. However profoundly hearing-impaired children show a wide range of spoken language abilities, some having highly intelligible speeches while others have unintelligible ones. This is due to hearing-impaired children's speech production. While hearing-impaired children speak, segmental and prosodic errors occur, so the intelligibility of their speeches is affected. Because of these segmental and prosodic errors, speaking rate of hearing-impaired children can be slower than that of hearing children. The aim of the current study is to find out if there are any differences between normal and hearing-impaired children's speech rate. Relationships between speech rateintelligibility, hearing loss, and ear-aided threshold of hearing impaired children were investigated as well. Twenty-five prelingual profound hearing-impaired high school students' speech samples were compared with those of 15 normal hearing students. Speech rate data was collected by means of a laryngogrph, while speech intelligibility was decided through examining statements produced by naive listeners who rewrote statements of hearing impaired-children. Findings revealed a difference between speech rate of hearing and hearing impaired children and a relationship between speech rate and speech intelligibility. However, no relationship was found between hearing loss and speech rate, hearing loss and intelligibility, ear aided threshold and speech rate, and ear aided threshold and intelligibility. Implications for the education of hearing impaired children were provided.

Keywords*:* Deaf, Hearing-Impaired Education, Speech rate, Intelligibility.

INTRODUCTION

Individuals' adaptation with the society and their success are mostly empowered through their fluent and efficient use of communication channels. The core of interpersonal communication is language and its verbal dimension, speaking (Konrot, 1991; Vardar, 1982). Speaking is one of the most immensely and frequently applied communication modes in interpersonal communication. Children acquire their native language and its verbal channel, speaking, through their hearing ability starting from birth. They start using the language for communication in an efficient and fluent manner in a short span of time, three to four years. Hearing carries an important role in the acquisition of speaking skills (Rabin et all, 1999). However, hearing loss occurring before speaking acquisition severely interferes with the acquisition of the mother tongue and speaking (Osberger & Mc-Garr, 1982). This situation influence hearing children's chance to acquire the culture of the society they live in along with an interruption in their intellectual development (Tüfekçioğlu, 1989). Such problems lead to defects in hearing impaired children's communication process (Sanders, 1971).

In order for speech production to occur, feedbacks from interconnected sensorial channels should be perceived sufficiently. Through these feedbacks, speakers can control their voice along with segmental and suprasegmental features of their speech, and correct their mistakes. In order to realize this function, speakers' primary duty becomes relying on the hearing channel (Rabin, et all, 1999). Insufficiency or total lack of aural feedbacks stemming from sensory-neural hearing handicap leads to defects in hearing impaired individuals' ability to notice and correct their speech deficiencies and mistakes. As a result, speech patterns of hearing impaired individuals deviate from normality. Studies revealed that segmental errors occur in the production of vowel and consonant phonemes (Hudings & Numbers, 1942; Markides, 1970; Osberger & Mc-Garr, 1982). Suprasegmental errors on the other hand, stem from situations such as intonation deficiencies caused by poor control of fundamental frequency (e.g. monotonous speech), inappropriate breath control, slow speaking rate, abnormal uses of pauses, and abnormal uses of rhythms and stresses (John & Howarrth, 1965; Markides, 1970; Leder, at all, 1978; Girgin, 1999).

Speech intelligibility of hearing impaired children is affected by several factors including the degree of hearing loss, hearing aid wearing age, proper selection and use of hearing aids, learning settings and instructional approaches. Speech intelligibility has a crucial role in verbal communication. Speech intelligibility can be defined as the accuracy of what hearing impaired individual delivers through speech and intelligibility of this speech by a normal listener (Tüfekçioğlu, 1989; Gordan & Brannan, 1994; Osberger & Mcgarr, 1982; Brannon, 1986). It has been emphasized since the study of Hudgins and Numbers (1942) that, there is a significant relationship between prelingually hearing-impaired children's speech intelligibility and the degree of hearing loss. Studies scrutinizing on speech rate, degree of hearing loss and ear-aided thresholds are rarely conducted for Turkish language, which necessitates new researches on the area (Girgin, 1999). Thus, the current study examines Turkish-speaking hearing impaired children and aims to answer the following research questions:

1- Do hearing children differ from hearing impaired children in terms of speech rate?
2- Is there a relationship between speech intelligibility and speech rate?
3- Is there a relationship between hearing loss and speech rate?
4- Is there a relationship between hearing loss and intelligibility?
5- Is there a relationship between ear-aided threshold and speech rate?
6- Is there a relationship between ear-aided threshold and intelligibility?

METHOD

Subjects

In order to form the control group, 15 hearing high-school teenagers were randomly selected from a list of students who were reported to have no hearing or speaking problems. The experiment group constituted all of 25 hearing impaired students enrolling at the high-school of the Education and Research Center for Hearing Impairment Children (İÇEM) at Anadolu University. When this group was formed, attention was paid to specific criteria, that is, (i) they should have sensory-neural hearing handicap in both ears, (ii) they should have prelingual hearing impairment, and (iii) they should not have a second handicap along with hearing impairment. The average degree of hearing loss calculated for the best hearing ears of all 25 students ranged between 89dB HL and 120dB HL (Mean: 102 dB HL).

Stimuli

In order to investigate the research questions, a set of 30 pictures along with 30 sentences written on cards was used. While selecting pictures, great attention was paid to the condition that contents of pictures were easy to express and familiar to hearing impaired children's lives. Sentences, on the other hand, were selected by classroom teachers based on the criteria that they were appropriate for their language proficiency.

Procedures

In a quite room, both hearing and hearing impaired children selected 15 sentences out of 30, and their speech rate was analyzed through recording the statements with a Laryngograph, an instrument used to record the larynx movements in speech. Means of 15 statements for both hearing and hearing impaired children were calculated and the variable of speech rate was found. These means were compared through conducting independent-samples t-test.

Speech intelligibility of hearing children was considered as 100 %. In order to calculate speech intelligibility of hearing impaired children, 15 statements read by them were listened three times by Navi Listeners who were accustomed to speeches of hearing impaired children. Then, these listeners were asked to take down what they heard of the statements. To calculate the speech intelligibility proportion for each hearing impaired children, the number of syllables changing the meaning was divided by the number of syllables understood correctly.

In order to answer further research questions that focused on relationships between variables, Pearson Product Moment Correlation Coefficients were calculated since all variables used in the current study had a continuous nature.

RESULTS

1st research question: Do hearing children differ from hearing impaired children in terms of speech rate?

In order to investigate whether hearing impaired children differ from hearing children in terms of speech rate, an independent-samples t-test was conducted. Means and standard deviations regarding these two groups are provided in the table below:

Table 1: Descriptive statistics regarding speech rate

GROUP	N	Mean	Std. Dev.	Min.	Max.
Hearing imp.	25,000	2,402	0,439	1,680	3,350
Hearing	15,000	1,985	0,585	1,300	3,800

The means in the table indicates the average of seconds spent for producing statements. That is, the less time spent for producing statements, lower means were observed, which meant that better speech rate was observed. In this respect, the hearing children had a better speech rate than hearing impaired children as suggested in Table 1. The significance of this difference was calculated through the independent-samples t-test which revealed a t-value of 2.567 with a corresponding significance level of .014. This result indicated that the difference between hearing impaired and hearing children in terms of speech rate was statistically significant (t_{38}=2.567; p>.014). More specifically, hearing children produced statements at a significantly shorter time than hearing impaired children.

2nd research question: Is there a relationship between speech intelligibility and speech rate?

In order to understand whether there was a relationship between speech intelligibility and speech rate, a Pearson Product Moment Correlation Coefficient between these two continuous variables was calculated. A coefficient of -.415 was found with a corresponding significance level of .008 indicating that there was a significant negative correlation between the two

variables. The result suggests that as the time spent for producing statements decreases, intelligibility increases (Table2).

3rd research question: Is there a relationship between hearing loss and speech rate?

In order to see whether there was a relationship between hearing loss and speech rate, another correlation coefficient was calculated. The r value of .057 with a significance of .787 indicated that there was not a significant relationship between hearing loss and speech rate (Table2).

4th research question: Is there a relationship between hearing loss and intelligibility?

To see the relationship between hearing loss and intelligibility, the correlation coefficient between the two variables was interpreted. The coefficient of -.348 with a significance of .088 indicated that there was not a statistically significant relationship between the two variables.

5th research question: Is there a relationship between hearing-aid threshold and speech rate?

The correlation coefficient between ear aided threshold and speech rate was examined to see whether there was a relationship between these two variables. The coefficient of -.125 with a probability level of .561 indicated that there was not a significant relationship between hearing-aid threshold and speech rate (Table2).

6th research question: Is there a relationship between ear-aided threshold and intelligibility?

Finally, the relationship between ear aided threshold and intelligibility revealed a coefficient of -.077 with a probability level of .720 which indicated that there was not a significant relationship between ear aided threshold and intelligibility (Table2).

Answers to 2nd, 3rd, 4th, 5th and 6th research questions are summarized within a single correlation matrix as provided in Table 2 below:

Table 2: Summary of 2nd, 3rd, 4th, 5th, and 6th research questions

	Speech intelligibility	Speech rate	Hearing loss	Ear Aided threshold
Speech intelligibility	-	**-,415***	-,348	-,077
Speech rate		-	-,057	-,125
Hearing loss			-	-,049

* Correlation is significant at the p-level of .05

DISCUSSION

As indicated in Table 1, speech rate (i.e. duration) of hearing impaired children was significantly slower than that of hearing children. In other words, their speech duration was longer in comparison to hearing children (John & Howarth 1965; Nickerson, 1975). This slowness in their speech deteriorates the quality of their speech patterns, and leads to labored and monotonous speech. Slowness observed in hearing impaired children's speeches generally stems from difficulty in controlling organs used in speech production, their abnormal use of pauses (i.e. unnecessary or longer pauses) which is caused by problems in adjusting breath, and longer time spent for producing phonemes. The best way to minimize hearing impaired children's problems in terms of speech rate is to use their existing but meager speech ability efficiently to improve their listening abilities.

As indicated in Table 2, there is a significant relationship between speech rate and speech intelligibility. More specifically, as the speech speed increases, children control their organs used in speech production better, control their breath more efficiently and use shorter pauses, which can have a positive influence on their speech intelligibility.

Nonetheless, the analyses did not reveal any relationship between hearing loss and speech rate, hearing loss and intelligibility, ear aided threshold and speech rate, and ear aided threshold and intelligibility. Particularly the findings revealing no relationship between intelligibility and hearing loss and between ear-aided threshold and intelligibility contradicted with some of previous studies. This finding might have been influenced by the profile of the participants who had either severe or profound hearing loss rather than partial hearing loss. Besides, the fact that these students were taught their mother tongue in a setting which provided instruction through auditory oral approach might have caused a relatively high speech intelligibility (Intelligibility; maximum: 99.23, minimum: 68.19, mean: 85.92).

The finding that indicated no relationship between speech rate and hearing loss and between speech rate and ear-aided threshold might have been caused by these students' being given the hearing aid at an early age and by being exposed to

efficient listening strategies.

The ultimate aim of the auditory oral approaches is to equip hearing impaired children with both intelligible speech skills (i.e. production) and listening comprehension (i.e. reception) (Girgin, 2005). Aural approaches based on intensive auditory and oral practices facilitate hearing impaired children's lives in the hearing society. Besides, these approaches help hearing impaired children speak intelligibly and fluently without confronting with any problem in the hearing society (Moeller, 2000).

Hearing impaired children should be equipped with most up-to-date hearing-aids provided by technology so that they could improve their speaking and language abilities starting from an early age. Besides both hearing impaired children and their families should be supported in instructional settings. This leads to the development of appropriate programs for the needs of hearing impaired children by using their residual hearing abilities in an efficient way (Cheng-Ju & Brown, 2004). While developing such programs, positive attitudes of families and teachers towards hearing impaired children, the cooperation between teachers and families and having high expectancies from hearing impaired children carries utmost importance (Clark, 1986; Tüfekçioğlu, 1998).

Hearing impaired children participated in the current study have been exposed to such an approach starting from an early age in the Education and Research Center for Hearing Impairment Children (İÇEM), an institution which has had above mentioned characteristics of an ideal training approach for more than 25 years. Therefore, some findings revealed in the current study differ from what is generally found in the literature.

REFERENCES

Brannon, J. B. (1986). The speech production and spoken language of the deaf. *Language and Speech 9*, 127-139.

Cheng-Ju., D. W., & Brown, P. M. (2004). Parents' expectations of auditory-verbal therapy. *The Volta Review 104*(1), 5-20.

Clark, M. (1986). Introduction: For which population is an auditory approach suitable. *The Volta Review 88*(5), 1-11.

Girgin, M. C. (1999). *Türkçe konuşan doğal işitsel sözel yöntemle eğitim gören işitme engelli kız çocukların konuşma anlaşılırlığı ile süre ve perde özellikleri ilişkisi*. Eskişehir: Anadolu Üniversitesi Yayınları No: 116.

Gordon, M., & Brannan, J. B. (1994). Assessing intelligibility. *Children's Expressive Phonologies 14*(2), 17-25.

Hudgins, C. V., & Numbers, F. C. (1942). An investigation of the numbers, F. C. speech of the deaf. *Genetic Psychology Monographs 25*, 289-392.

John, J. E. J., & Howarth, N. J. (1965). The effect of time distorstions on the intelligibility of deaf children's speech. *Language and Speech 8*, 127-134.

Konrot, A. (1991). Okul öncesi eğitim kurumlarında dil ve konuşma sorunlu çocuklar. *Ya-Pa 7 Okulöncesi Eğitim ve Yaygınlaştırma Semineri*. İstanbul: Yapa Yayınları.

Markides, A. (1970). The speech of deaf and partially-hearing children with special reference to factors affecting intelligibility. *British Journal of Disorders of Communication 5*, 126-140.

Moeller, M. P. (2000). Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics 106*, 32-43.

Nickerson. R. (1975). Characteristics of the speech of deaf person. *The Volta Review 77*(6), 611-622.

Osberger, M. J. & Mcgarr, N. S. (1982). Speech production characteristics of thehearing impaired. *Speech and Language 8*, 222-283.

Rabin, L., K.; Taitelbaum, T.; Tobin, Y. & Hildesheimer, M. (1999). The effect of partially restored of hearing on speech production of postlingually deafened adults with multichannel cochlear implants. *J. Accoust. Soc. Am. 106*(5), 2843-2857.

Sanders, A. D. (1971). *Aural rehabilitation.* New Jersey: Prentice–Hall.

Tüfekçioğlu, U. (1989). *Farklı eğitim ortamlarinda sözel iletişim eğitimi gören işitme engelli öğrencilerin konuşma dillerinin karşılaştırılması.* Yayınlanmamış doktora tezi, Anadolu Üniversitesi, Eskişehir.

Vardar, B. (1982). *Dilbilim temel kavram ve ilkeleri.* Ankara: T.D.K. Yayınları